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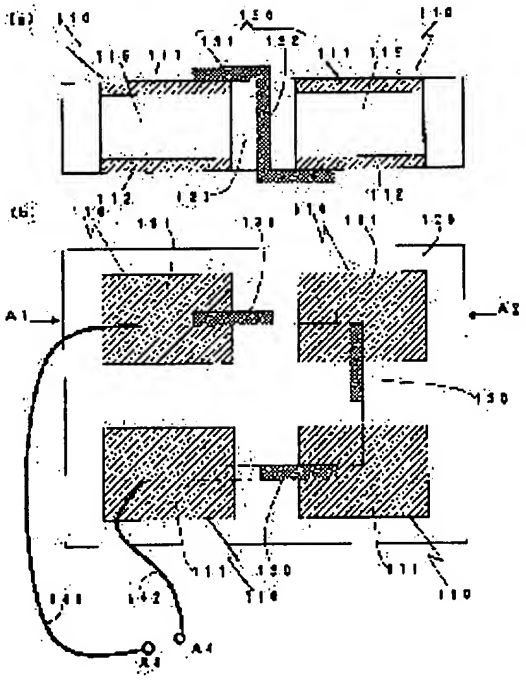
(54) HIGH POLYMER ELECTROLYTE FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a fuel cell with the structure, which connects electrically in series with the unit cells, prepared in the shape of a plane.

SOLUTION: It is a high polymer electrolyte fuel cell, in which two or more above unit cells are arranged into the shape of a plane by making each unit cells have the same direction, and the above two or more unit cells are connected in series electrically by connecting the predetermined unit cells, which adjoin, electrically in series, at least one of a through hole connection part, a filling via connection part, and a bump connection parts is prepared in an insulated part of the thickness of the approximately same thickness of the unit cell electrically insulated from each the unit cells, which have been prepared between the predetermined unit cells, which adjoin. Or, it is the high polymer electrolyte fuel cell, in which two or more pieces of some part of the high polymer film electrolyte of the shape of one board are arranged in a plane-like shape by making each the unit cells have the same direction as its electrolyte film, and the above two or more unit cells are connected in series electrically by connecting between the predetermined unit cells, which adjoin, electrically in series, at least one of the through hole connection part, the filling via part, and the bump connection part is prepared in the above high polymer film electrolyte between the predetermined adjoined unit cells.



LEGAL STATUS

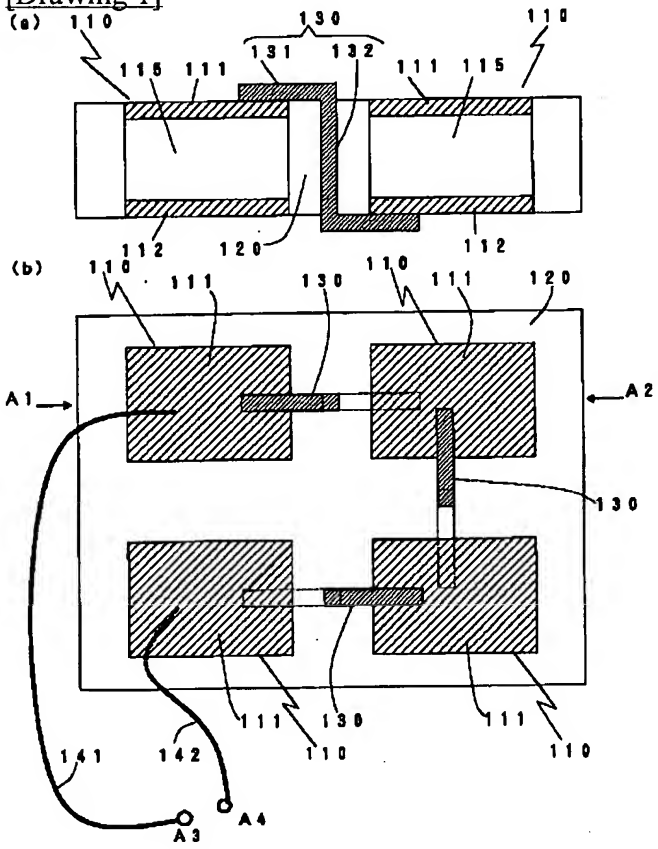
[Date of request for examination]

* NOTICES *

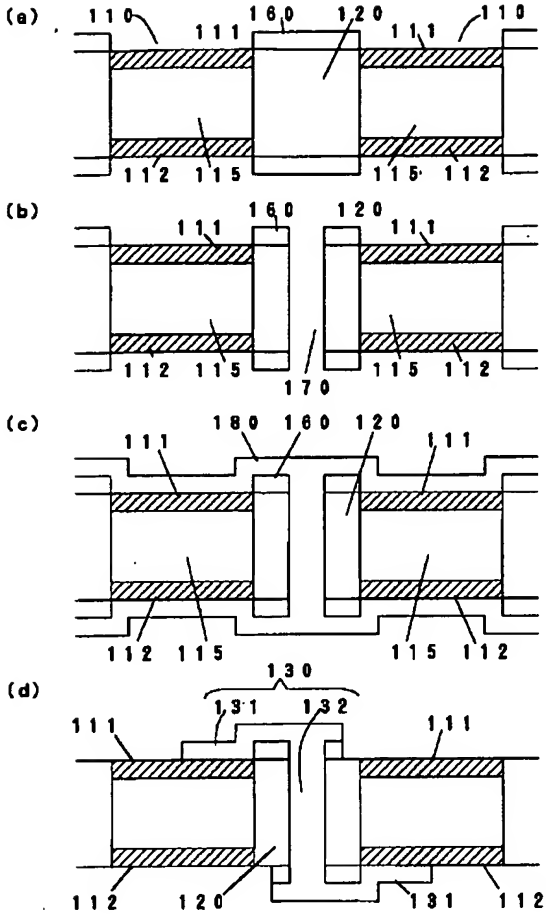
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

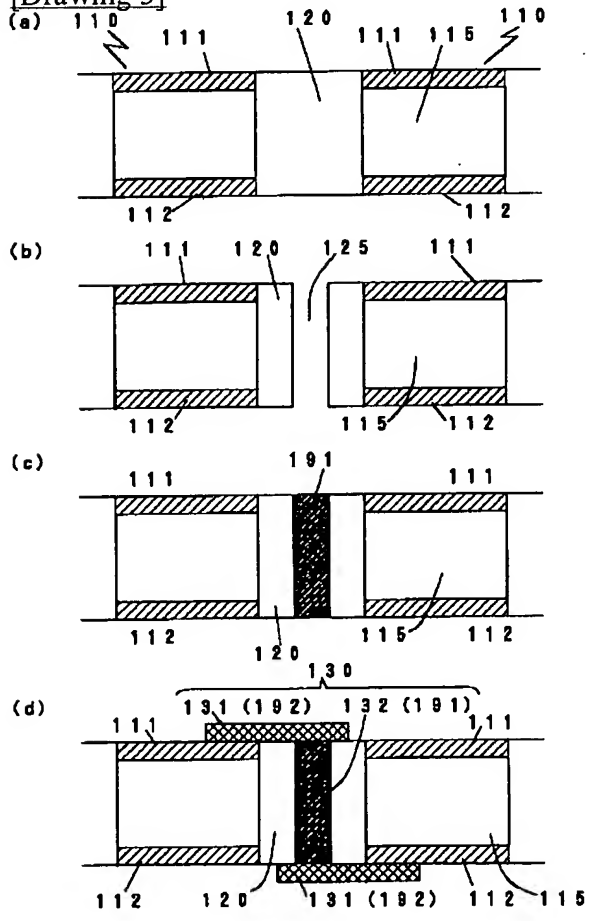
[Drawing 1]



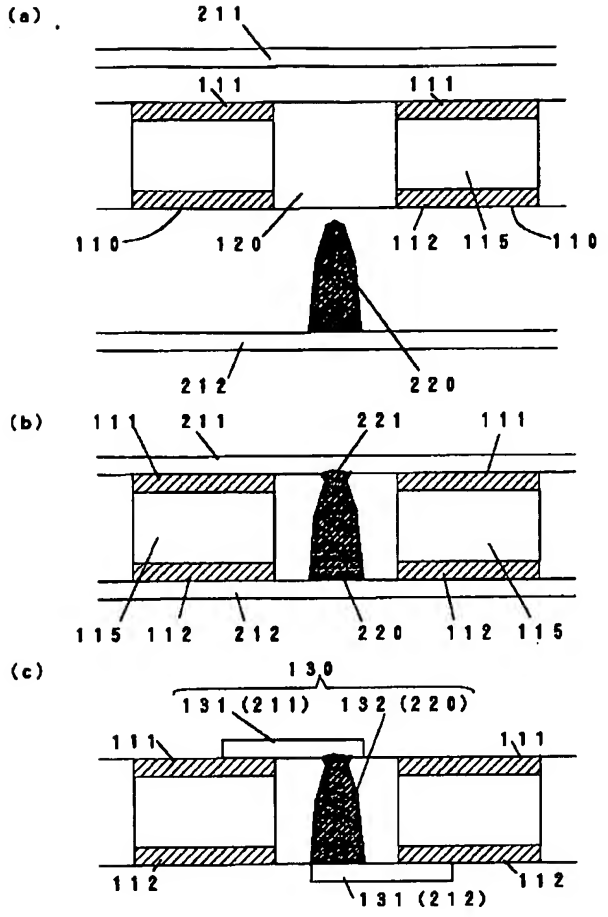
[Drawing 2]



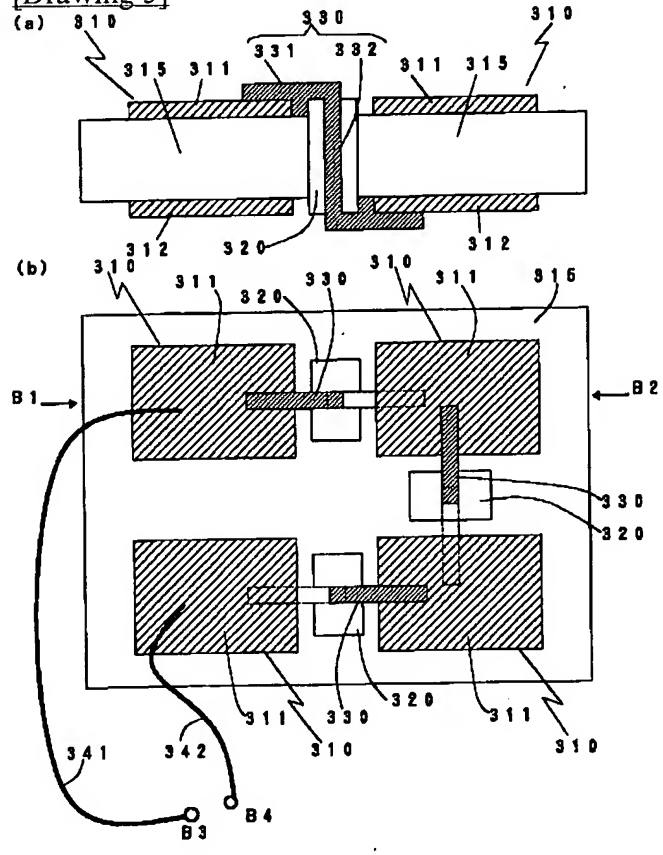
[Drawing 3]



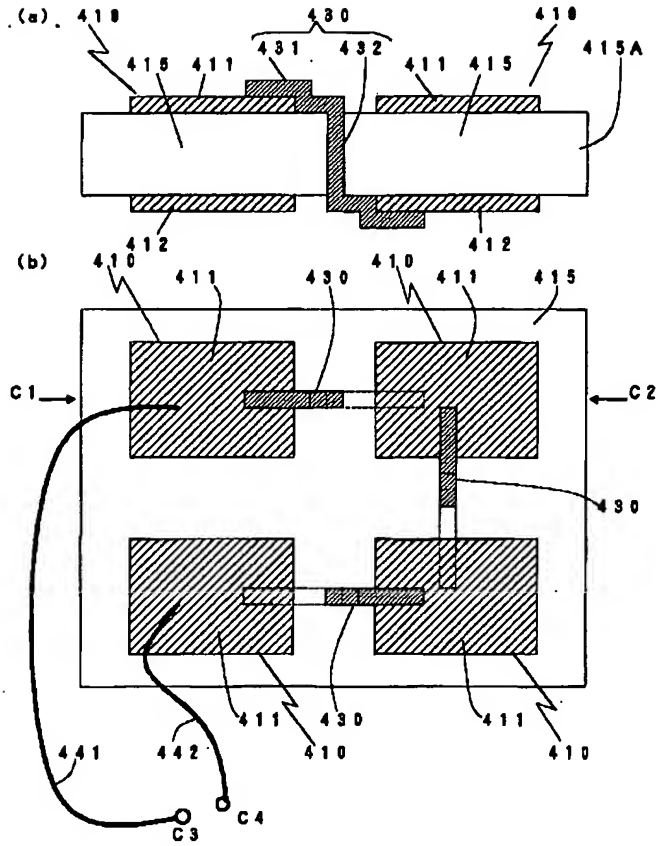
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the polyelectrolyte mold fuel cell which made each unit cell the same direction, arranged more than one in the plane, connected to the serial electrically between the unit cells which predetermined adjoins, and connected said two or more unit cells to the serial.
[0002]
[Description of the Prior Art] Recently, the expectation for a fuel cell has been growing rapidly from the viewpoint of earth environmental protection, the point [if hydrogen is used as a direct fuel, it is advantageous, and] that an energy conversion efficiency is high, etc. Until now, although used for space development or ocean development, recently, it was developed to the home power plant instead of being the engine of an automobile, and possibility of being used widely became large. Although a fuel cell is equipment which supplies continuously a fuel (reducing agent), oxygen, or air (oxidizer), is made to react electrochemically, and takes out electrical energy from the exterior simply and it may classify according to the class of the operating temperature and use fuel, an application, etc. Are large by the class of electrolyte mainly used recently. A solid acid ghost mold fuel cell (SOFC), It is common to be classified into five kinds of a fused carbonate fuel cell (MCFC), a phosphoric acid fuel cell (PAFC), a polyelectrolyte mold fuel cell (PEFC), and an alkali water-solution mold fuel cell (AFC). Although these use as a fuel the hydrogen gas generated from methane etc., the direct methanol mold fuel cell (DMFC) which uses a methanol water solution direct as a fuel is also known for recently.
[0003] Under these circumstances, the polymer electrolyte fuel cell (henceforth a polyelectrolyte mold fuel cell or PEFC:Polymer Electrolyte Fuel Cell) of a configuration of having put the solid-state poly membrane with two kinds of electrodes, and having pinched these members with the separator further also in the fuel cell, attracts attention. This PEFC arranges electrodes, such as an air pole (oxygen pole) and a fuel electrode (hydrogen pole), on both sides of a solid-state poly membrane, constitutes a unit cell, and has composition which sandwiched the both sides of this unit cell with the separator for fuel cells. The fuel electrode and air pole which consist of a catalyst bed with a thickness of 10 micrometers - 20 micrometers are formed in the both sides of a polyelectrolyte with a thickness of 20 micrometers - 70 micrometers, it unites with them, porous supporters (carbon paper, about 80% of porosity) are given to a catalyst bed outside as current collection material, and it is pinched with the separator (diaphragm) which serves as the supply way of reactant gas, such as hydrogen and oxygen, further. It is necessary to carry the hydrogen ion (proton) which isolates these and is generated with a fuel electrode to an air pole side so that a fuel (hydrogen) and an oxidizer (air) may not carry out a direct reaction. It operates in ordinary temperature (100 degrees C or less), and with the fuel cell with which a proton moves in a solid poly membrane, the thin film (about 50 micrometers in thickness) which has the perfluorocarbon sulfonic acid structure which has a sulfonic acid group as an ion exchange group in a solid-state poly membrane can be used, and a compact cell can be built. Output engine performance is 1 - 3 A/cm2 and a 0.6 - 2.1V/single cel, and is 2.1 W/cm2. High power density is obtained.
[0004] In this PEFC, it may be required for the both sides of a solid-state poly membrane, respectively that the object for personal digital assistants etc. should be a flat-surface mold for example, without needing electromotive force so much, and it should be thin as much as possible although the stack structure thing (it is also called a PEFC stack) which carried out the laminating of two or more unit cells which have arranged the electrode, and was enlarged [for the purpose of that electromotive force] is common.
[0005]

[Problem(s) to be Solved by the Invention] As mentioned above, although possibility that a fuel cell would be used widely in recent years became large and it is coming, a PEFC smell is a flat-surface mold and the thing of the thinnest possible gestalt has also come to be required. This invention tends to correspond to this and it is going to offer a fuel cell with the structure which connected to the serial electrically the unit cell prepared in the plane.

[0006]

[Means for Solving the Problem] The polyelectrolyte mold fuel cell of this invention makes each unit cell the same direction, and arranges it in a plane, and between the unit cells which predetermined adjoins is electrically connected to a serial. [two or more] In order to make electric connection between the unit cells which it is the polyelectrolyte mold fuel cell which connected said two or more unit cells to the serial, and predetermined [said] adjoins It is characterized by having prepared at least one of a SURUHORU connection, a restoration beer connection, and the bump connections in the insulating section of the thickness of the abbreviation unit cell electrically insulated with each unit cell prepared between the unit cells which predetermined [said] adjoins. The polyelectrolyte mold fuel cell of this invention a part of one tabular poly membrane electrolyte moreover, as the electrolyte membrane Make each unit cell into the same direction, arrange more than one in a plane, and between the unit cells which predetermined adjoins is electrically connected to a serial. In order to make electric connection between the unit cells which it is the polyelectrolyte mold fuel cell which connected said two or more unit cells to the serial, and predetermined [said] adjoins It is characterized by having prepared at least one of a SURUHORU connection, a restoration beer connection, and the bump connections in the poly membrane electrolyte between the unit cells which predetermined [said] adjoins.

[0007]

[Function] The polyelectrolyte mold fuel cell of this invention enables offer of a fuel cell with the structure which connected electrically to the serial two or more unit cells prepared in the plane by making it such a configuration. Namely, by preparing the insulating section of the thickness of the abbreviation unit cell electrically insulated with each unit cell between the unit cells which predetermined adjoins Or by making each unit cell into the same direction, as a poly membrane electrolyte is arranged between unit cells, and arranging two or more a part of one tabular poly membrane electrolyte in a plane as the electrolyte membrane The technique of the SURUHORU connection used widely conventionally, restoration beer connection, and bump connection shall be electrically [between unit cells] applicable to in-series connection.

[0008]

[Embodiment of the Invention] The example of a gestalt of operation of the polyelectrolyte mold fuel cell of this invention is explained based on drawing. Drawing 1 (a) is the sectional view of the 1st example of the gestalt of operation of the polyelectrolyte mold fuel cell of this invention. Drawing 1 (b) is the top view, and drawing 2 is a production process Fig. at the time of making a restoration type SURUHORU connection into a front flesh-side connection in the 1st example. Drawing 3 is a production process Fig. at the time of making a restoration beer connection into a front flesh-side connection in the 1st example. Drawing 4 is a production process Fig. at the time of making a bump connection into a front flesh-side connection in the 1st example. Drawing 5 (b) is the top view, drawing 5 (a) is the sectional view of the 2nd example of the gestalt of operation of the polyelectrolyte mold fuel cell of this invention, and drawing 6 (b) is [drawing 6 (a) is the sectional view of the 3rd example of the gestalt of operation of the polyelectrolyte mold fuel cell of this invention, and] the top view. drawing 1 - drawing 6 -- setting -- 110 -- a unit cell and 111 -- a fuel electrode side separator (a charge collector --) 112 called electrode Or an air pole side separator (it is also called a charge collector or an electrode), In 115, a poly membrane electrolyte and 120 a through tube and 130 for the insulating section and 125 A connection, In 131, connection wiring and 132 wiring and 160 for a front flesh-side connection, and 141 and 142 Copper foil, 170 a plating layer, and 191 and 192 for a through tube and 180 Conductive paste, In 211 and 212, copper foil and 220 the contact section and 310 for a bump and 221 A unit cell, 311 -- a fuel electrode side separator (it is also called a charge collector or an electrode) and 312 -- an air pole side separator (a charge collector --) A poly membrane electrolyte and 320 315 called electrode Or the insulating section, In 330, a connection and 331 wire and, as for a front flesh-side connection, and 341 and 342, connection wiring and 332 wire. A unit cell and 411 410 A fuel electrode side separator (it is also called a charge collector or an electrode), 412 -- an air pole side separator (it is also called a charge collector or an electrode) and 415 -- for the insulating section and 430, as for connection wiring and 432, a front flesh-side connection, and 441 and 442 are [a poly membrane electrolyte and 415A / a tabular poly membrane electrolyte and 420 / a connection and 431] wiring. In addition, drawing 2 - drawing 4

are drawings of connection 130 near [drawing 1 (a)]. Moreover, drawing 1 (a) is a sectional view in A1-A2 of drawing 1 (b), drawing 5 (a) is a sectional view in B1-B-2 of drawing 5 (b), and drawing 6 (a) is a sectional view in C1-C2 of drawing 6 (b). Moreover, C3 and C4 are the output terminal sections among B3, B4, and drawing 6 (b) among A3, A4, and drawing 5 (b) among drawing 1 (b).

[0009] First, the 1st example of the gestalt of operation of the polyelectrolyte mold fuel cell of this invention is explained based on drawing 1 . The polyelectrolyte mold fuel cell of the 1st example is a polyelectrolyte mold fuel cell which arranges two or more unit cells 110 to a plane, connects these to a serial electrically, and takes out the electrical potential difference for the number (drawing 1 four pieces) of a unit cell as shown in drawing 1 . the surroundings of each unit cell 110 -- this and abbreviation -- the insulating section 120 of the same thickness was formed, the whole is made into the plane, simply, it is in the condition which inserted the unit cell in the **** omission section of the plate-like insulating section, and a unit cell 110 and the insulating section 120 are formed in the plane. This example forms the front flesh-side connection 132 for penetrating the insulating section in the insulating section 120 which was prepared between the unit cells which predetermined adjoins and which was electrically insulated with each unit cell, and connecting the front flesh side to it. And this, Between the unit cells which while adjoins, and connect by the fuel electrode side separator (it is also called a charge collector or an electrode) of a unit cell and the air pole side separator (it is also called a charge collector or an electrode) of the unit cell of another side, and the wiring connection 131, and adjoin is electrically connected to a serial. In addition, although the number of a unit cell is made into four pieces by drawing 1 here in order to give explanation intelligible, five or more pieces are sufficient. Except connection 130 (the connection wiring 131 and front flesh-side connection 132) which is wiring which connects between the adjoining unit cells as the insulating section 120, it is made to insulate mutually, and if excelled in the field of processability and endurance, especially limitation will not be carried out. As an ingredient for insulating section 120, a substrate ingredient is used, for example, glass epoxy, polyimide resin, etc. are usually used. The structure where what consists only of an insulating material contains a part of conductive thing is sufficient as the insulating section 120. As a connection 130, although a SURUHORU connection, a restoration beer connection, or a bump connection is prepared into the insulating section 120, these can be formed as application of the conventional wiring substrate technique. Although it is equal to use conductivity, reinforcement, and in respect of corrosion resistance and what has good connectability with the connection wiring 131 is desirable as the quality of the material of the fuel electrode side separator 111 of a unit cell 110, and the air pole side separator 112, metal material is used, for example, stainless steel, a cold rolled steel plate, aluminum, etc. are usually applied. Or as a separator 112, these metal material is used as a base material, and what arranged in the field by the side of a poly membrane electrolyte the resin film which has acid resistance and electric conductivity is applied.

[0010] Hereafter, based on drawing 2 , the flow of the processing is briefly explained for one example of the manufacture approach of the polyelectrolyte mold fuel cell of this example about the case where the front flesh-side connection 132 of a connection 130 is made into a restoration type SURUHORU connection. The pore which inserts in a unit cell is beforehand formed using the double-sided ****** glass epoxy group plate (not shown), and a unit cell is inserted in the pore at the same direction.

(Drawing 2 (a))

Subsequently, the through tube 170 for forming a restoration type SURUHORU connection is opened with a drill or laser. (Drawing 2 (b))

Subsequently, after performing DESUMIA processing and catalyst grant processing, nonelectrolytic plating is performed all over the surface section of the through tube section being included, electrolysis plating is further performed on a nonelectrolytic plating layer, a through tube (170 of drawing 2 (b)) is filled up with the plating layer 180, and it is made to flow through a front flesh side. (Drawing 2 (c))

As nonelectrolytic plating, non-electrolyzed nickel plating, non-electrolytic copper plating, etc. are performed suitably. After nonelectrolytic plating performs activation with a catalyst, predetermined plating liquid performs it. Moreover, as electrolysis plating, copper plating is usually performed.

Subsequently, resist platemaking is performed at the whole front rear face, plating layer 180 part exposed from the resist is etched, the connection wiring 131 is formed (not shown), washing processing is performed removal of a resist, and if needed, and the polyelectrolyte mold fuel cell of this example is obtained. (Drawing 2 (d))

For example, as an etching reagent, what can etch the plating layer 180 alternatively independently in the fuel electrode side separator 111 and the air pole side separator 112 is used. Etching conditions are determined in consideration of the quality of the material of a separator, and the etching rate of copper

wiring, using ferric chloride liquid etc. as an etching reagent. In addition, although the through tube 170 was filled up with the plating layer 180, it is good here also as an ordinary SURUHORU connection which enlarges the through tube 170 and is made into the condition that the through tube has still penetrated on the front reverse side, after plating.

[0011] Subsequently, based on drawing 3 , the flow of the processing is briefly explained for one example of the manufacture approach of the polyelectrolyte mold fuel cell of this example about the case where the front flesh-side connection 132 of a connection 130 is made into a restoration beer connection. The pore which inserts in a unit cell is beforehand formed using the glass epoxy group plate (not shown), the unit cell is inserted in the same direction at the pore (drawing 3 (a)), and the through tube 125 for forming the restoration beer section is opened with a drill or laser. (Drawing 3 (b)) subsequently, screen-stencil etc. -- using -- a conductive paste -- uniform thickness -- applying -- a hole -- a through tube 125 is made to fill up with the conductive paste 191 by arranged and decompressing an aspirator implement in the substrate background which processed it (Drawing 3 (c))

Subsequently, the conductive paste 192 is printed in print processes, the connection wiring 131 is formed, and the polyelectrolyte mold fuel cell of this example is obtained. (Drawing 3 (d))

As a conductive paste, a silver paste, a copper paste, a golden paste, a palladium paste, a palladium-silver paste, etc. are mentioned.

[0012] Subsequently, based on drawing 4 , the flow of the processing is briefly explained for one example of the manufacture approach of the polyelectrolyte mold fuel cell of this example about the case where the front flesh-side connection 132 of a connection 130 is made into a bump connection. The pore which inserts in a unit cell is beforehand formed using insulating substrates, such as a glass epoxy group plate, (not shown), the unit cell is inserted in the pore at the same direction, the copper foil 212 in which the conductive bump 220 was formed is prepared (drawing 4 (a)), and the laminating of these is carried out to the copper foil 211 and field side of another side at an insulating-substrates side, such as the glass epoxy group plate, at the field side of one of these. (Drawing 4 (b))

A bump 220 can apply what covered further the thing which printed and carried out bump formation or wire bump of the multiple times of a conductive paste, and the wire bump with a conductive paste. In addition, in case a bump is produced, while obtaining the height of the bump section, the tip is sharpened keenly. Subsequently, resist platemaking is performed at the whole front rear face, plating layer 180 part exposed from the resist is etched, the connection wiring 131 is formed (not shown), washing processing is performed removal of a resist, and if needed, and the polyelectrolyte mold fuel cell of this example is obtained. (Drawing 3 (d))

[0013] Limitation is not carried out for the formation approach of a connection 130 shown in drawing 2 - drawing 4 to this by one example. By preparing the insulating section of the thickness of the abbreviation unit cell electrically insulated with each unit cell in this way between the unit cells which predetermined adjoins, the SURUHORU connection used widely conventionally, restoration beer connection, bump connection, etc. can be taken as a connection 130, and it is uninfluential of formation of a connection 130 to each unit cell, and the 1st example makes it stable electrically.

[0014] Next, the 2nd example of the gestalt of operation of the polyelectrolyte mold fuel cell of this invention is explained based on drawing 5 . The 2nd example is the polyelectrolyte mold fuel cell which arranges two or more unit cells 310 to a plane, connects these to a serial electrically like the 1st example, and takes out the electrical potential difference for the number (drawing 5 four pieces) of a unit cell. It is what forms the insulating section 320 of the same thickness and has made the whole the plane. the part between the unit cells 310 which form a connection 330 -- this and abbreviation -- so to speak It is the thing of the structure which puts some poly membrane electrolytes 320 between the adjoining unit cells which form the front flesh-side connection 332 on the insulating section 320, and has been replaced with. In the case of the 2nd example, the fuel electrode side separator [two or more / the both sides of the poly membrane electrolyte 320 of the shape of one plate / respectively / (drawing 5 four pieces)] 311 and the air pole side separator 312 are arranged in the condition of having separated, and the fuel electrode side separator 311 of each unit cell and the air pole side separator 312 are the same magnitude, it is facing in the same location, and each unit cell is separated. The sense of each unit cell is the same, and a front flesh-side connection is surely electrically needed for a ****** sake at a serial. In the insulating section 320 by which it was prepared between the unit cells which predetermined adjoins also in the 2nd example and which was electrically insulated with each unit cell The front flesh-side connection 332 for penetrating the insulating section and connecting the front flesh side like the case of the 1st example, is formed. This, Between the unit cells which while adjoins, and connect by the fuel electrode side separator 311 of a unit cell and the air pole side separator 312 of the unit cell of another

side, and the wiring connection 331, and adjoin is connected electrically. In addition, although the number of a unit cell is made into four pieces by drawing 5 also here in order to give explanation intelligible, five or more pieces are sufficient. Also in the 2nd example, each part (quality of the material, structure, etc.) can apply the same thing as the case of the 1st example. Moreover, a SURUHORU connection, a restoration beer connection, or a bump connection is prepared into the insulating section 120 as a connection 330 1st similarly [in the 2nd]. Fundamentally as a front flesh-side connection 332, formation of the connection 330 containing a SURUHORU connection or a restoration beer connection, and a bump connection can be performed like the process which was explained in the case of the example [1st]. By forming the insulating section 320 of the thickness of the abbreviation unit cell which was insulated as electrically [between the predetermined unit cells to adjoin] in this way as each unit cell also in the 2nd example As a connection 330, like the case of the 2nd example, the SURUHORU connection used widely conventionally, restoration beer connection, bump connection, etc. can be taken, and it is uninfluential of formation of a connection 330 to each unit cell, and is considering as the stable thing electrically.

[0015] Next, the 3rd example of the gestalt of operation of the polyelectrolyte mold fuel cell of this invention is explained based on drawing 6 . The 3rd example a part of one tabular poly membrane electrolyte 415A of large size from one unit cell size as an electrolyte membrane of each unit cell Make each unit cell into the same direction, arrange more than one in a plane, and between the unit cells which predetermined adjoins is electrically connected to a serial. With the polyelectrolyte mold fuel cell which connects two or more unit cells of all to a serial, and takes out the electrical potential difference for the number (drawing 6 four pieces) of a unit cell In order to make electric connection between the unit cells which predetermined adjoins, the front flesh-side connection 432 is formed in the poly membrane electrolyte between the unit cells which predetermined [said] adjoins. Between the unit cells with which it connects by the fuel electrode side separator 411 of a unit cell and the air pole side separator 412 of the unit cell of another side, and the wiring connection 431 and which also in the 3rd example while adjoins the front flesh-side connection 432, and are adjoined is connected electrically. In addition, although the number of a unit cell is made into four pieces by drawing 6 also here in order to give explanation intelligible, five or more pieces are sufficient. In the 3rd example as well as the 1st example and the 2nd example, a SURUHORU connection or a restoration beer connection, a bump connection, etc. are prepared in the poly membrane electrolyte between the unit cells which predetermined [to connect] adjoins as a connection 430. Fundamentally as a front flesh-side connection 432, formation of the connection 430 containing a SURUHORU connection or a restoration beer connection, and a bump connection can be performed like the process which was explained in the case of the example [1st]. Also in the 3rd example, gestalten, such as SURUHORU connection used widely conventionally, restoration beer connection, and bump connection, shall be taken by making each unit cell into the same direction as a connection 430, as a poly membrane electrolyte is arranged between unit cells, and arranging two or more a part of one tabular poly membrane electrolyte in a plane as the electrolyte membrane, in this way.

[0016] In the above, the 1st example - the 3rd example, although it is only what arranged two or more unit cells to the plane, the gestalt in the condition (it was made the shape of a stack) of having piled up two or more things of such structure further is also mentioned. In addition, connection of the direction of a laminating of the output terminal section (equivalent to B3 of A3 of drawing 1 , A4, and drawing 5 , B4, and C3 and C4 of drawing 6) can be taken like the conventional stack structure in this case.

[0017]

[Effect of the Invention] This invention enabled offer of a fuel cell with the structure which connected to the serial electrically the unit cell prepared in the plane as mentioned above.

[Translation done.]